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LITANI RIVER BASIN MANAGEMENT SUPPORT PROGRAM

WATER QUALITY SURVEY – DRY SEASON

VOLUME II - APPENDICES

FEBRUARY 2011
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LITANI RIVER BASIN MANAGEMENT SUPPORT PROGRAM

WATER QUALITY SURVEY – DRY SEASON (SUMMER 2010)
VOLUME II – APPENDICES

Contract No.: EPP-I-00-04-00024-00 order no 7.

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1. APPENDIX 1 : DETAILED RESULTS

INCLUDED IN MAIN REPORT

2. APPENDIX II: FIELD DATA FORMS

Name of City/Village: ----------

2.1. DOMESTIC PROFILE

1.1. Source of Domestic Water: ----------

1.1.a. Location and name of water springs: ----------

(GPS Ref.# and photo ID):----------

2.2. MANAGEMENT OF WASTEWATER

☐ Cesspools ☐ Sewerage System

1.2.a. Final Disposal site of Sewerage Network:

☐ Direct Disposal into Litani River: GPS Ref # & photo ID ----------

☐ Wastewater Treatment Facility: GPS Ref # & photo ID ----------

2.3. MANAGEMENT OF MUNICIPAL SOLID WASTES

☐ Dump Site: GPS Ref # and photo ID: ----------

 Treatment Facility: GPS Ref# and photo ID:----------
--

1.

2. Agricultural Profile

2.3. Type of Crops: Winter:---------- Summer:----------

2.4. Type of Irrigation: Spray Drip Both

2.3. Type of Irrigation Water: River water Well water Wastewater

Secondary treated wastewater effluent

3. Industrial Profile:

3.3. Type of industrial Activities:

a. ----------(GPS Ref.# and photo ID)
b. ----------(GPS Ref.# and photo ID)
c. ----------(GPS Ref.# and photo ID)
d. ----------(GPS Ref.# and photo ID)

4. **Recreational Activities: ----------**

3. APPENDIX III: SOURCES OF POLLUTION AND SAMPLED SITES

3.1. THE YELLOW ZONE (UPPER)

Table 1: The Codes of Cities and Villages Surveyed in the Yellow Zone

ABL	Ablah	ابلح
BDL	Bednayl	بدنايل
CHM	Chemistar	شمسطار
FRZ	Ferzol	فرزل
HEL	Helaniyeh	الحلانية
HEZ	Hezeine	حزين
HRF	Housh Al Rafka	حوش الرافقة
HSD	Housh Sneid	حوش سنيد
HWB	Housh Barda	حوش بردا
JNT	Janta	جنتا
MAS	Masa	ماسا
RYK	Rayak	رياق
SAD	Saidi	سعيدة

SAR	Sareine	سرعين
SFR	Sifri	صفري
TMF	Temnine Al Fawka	تمنين الفوقا
TMT	Temnine Al Tahta	تمنين التحتا
TRY	Taraya	طريا
YHF	Yehfoufa	يحفوفا

Table 2: Yellow Region Point and Nonpoint Sources of Pollution

Upper Litany Basin	**Location to River Basin**		**Profile of Village/City**			**Major Sources of Pollution**		**GPS Reference**
						Type of Source		
Village/ City	**West**	**East**	**Residential**	**Agricultural**	**Industrial**	**Point Sources**	**Non-Point Sources**	
1a. Al Saidi (SAD)	West		X Residential & Agricultural in addition to Bedouins' Settlements	X			Agriculture Runoff	
1.b. Housh Barada (HWB)		East		X Mainly Agricultural (tobacco plantation)			Agriculture Runoff	
2.a. Taraya (TRY)	West		X Residential, Agricultural and Recreational Contributes the Housh Bay Tributary originating from Housh Bay Spring (Roman ruins)	X		Domestic Wastewater Outlet from Taraya & Chmistar	Agriculture Runoff	132
2.b Housh Sneid (HSD)		East	X Mainly Agricultural (Wheat, Vegetables and Tobacco plantation) In addition to a major Dairy Plant(Liban Lait)	X		WW Outlet from Housh Sneid WW from Liban Lait Industry	Agricultural Runoff	133 -

3.a. Chemistar (CMT)	West		X X Residential and Agricultural and Small Scale Dairy Plants	Domestic Wastewater Flows into Housh Bay Tributary (Same Outlet as WW from Taraya and Chemistar)	Agricultural Runoff	132
3.b. Hezeine (HEZ)		East	X X Mainly Agricultural (Tobacco Plantation)	Domestic Wastewater Dump Site for Solid Wastes	Agricultural Runoff	29 29
4.a Bednayl (BDL)	West		X X Wastewater (Sewerage System mostly and Cesspools) tapped directly and used for irrigation	Domestic Wastewater	Agricultural Runoff	Not determined as river bed is dry and/or outlet is subsurface
4.b.i. Housh Rafka (HRF)		East	X X Wastewater tapped directly and used for irrigation	Domestic Wastewater	Agricultural Runoff	Not determined as river bed is dry and/or outlet is subsurface
4.b.ii. Sifri (SFR)		East	X X All Water Springs are Dry	Domestic Wastewater		Not Determined (Between Hizine &

			Main Well Closed by Government Wastewater Tapped for Agricultural Use (Sanitary Sewer not Completed and Cesspools are still in Use)		Agricultural Runoff	Hosh Rafka) as wastewater is tapped for Irrigation
5.a. Temnine Al Fawka (TMF)	West		X X <u>Contributes the Temnine Tributary originating from Jeb el Habach Spring (Roman Ruins)</u> Spring is fed by rain and snow melting from Neha Area		Agricultural Runoff & Cesspools	
5.b. Temnine AL Tahta (TMT)		East	X X X Major Rock-Cutting Industry	Industrial Wastewater	Agricultural Runoff	136
6.a.i. Ablah (ABL)	West		X X Mainly Agricultural and Industrial (Main Poultry Plant and Plastic industry) Solid Wastes Disposed in Zahle Landfill	Industrial Wastewater (Poultry Processing Plant) Domestic Wastewater (Wastewater Treatment Plant		42 (Not Determined as Outlet is Diffused; First Spotted at this Site) 39

				Under Construction) Solid Waste Dump adjacent to River	 Agricultural Runoff	 42
6.a.ii. Ferzol (FRZ)	West		X X X Major industry (Master potato Chips) <u>Contributes the Habbis/Fersol Tributary originating from Habbis Water Spring</u>	Possible Industrial Wastewater (Master potato Chips) Domestic Wastewater (Wastewater Treatment plant; Secondary level Treatment) Solid Waste Dump	 Agricultural Runoff	32 38 36
6.b. Rayak (RYK)		East	X X Lebanese Army Barraks and Residential Units		Agricultural Runoff and Cesspools	
7. Yahfoufa (YHF)		East	X X And Recreational Areas <u>Contributes the Yahfoufa/ Hala Tributary originating from Yahfoufa Spring (Jowsha Spring)</u>	Restaurants	Agricultural Runoff and Cesspools	127

			Tributary is exposed to WW from Sergaia (Mohafazat Al Zabadani in Syria			
8. Janta (JNT)		East	X X And Recreational Areas Contributes the Yahfoufa/ Hala Tributary originating from Yahfoufa Spring (Jowsha Spring)	Restaurants	Agricultural Runoff and Cesspools	126
9. Masa (MSA)		East	X X Contributes the Yahfoufa/ Hala Tributary originating from Yahfoufa Spring (Jowsha Spring)	Stone Cutting industry	Agricultural Runoff and Cesspools	125

Table 3: Yellow Region Sample Types and Location

Litani River Upper Basin	**Location to River Bed**		**Profile of Village/City**			**Proposed Sampling Sites**		**Quality Indicators for River Sampling Points**					
Village/ City	**West**	**East**	**Residential**	**Agricultural**	**Industrial**	**Type of Sample**	**Ref. GPS**	**T⁰C**	**pH**	**DO mg/l**	**CND uS**	**TDS mg/l**	**ORP mV**
1a. Al Saidi (SAD)	West		X Residential & Agricultural in addition to Bedouins' Summer Settlements	X		Litani R Water (adjacent river canal; used for irrigation in Summer and as a source of domestic water) Soil Well Water	20 22 21	23	8.0	8.51	450	330	170 (Presence of Fish and Tadpoles in Water; Minimal Water Flow; Mostly River Bed is Dry and Water Sampled is Mainly Well Water Pumped for Irrigation)
1.b. Housh Barada (HB)		East	X Mainly agricultural (Tobacco Plantation)			Litani R Water Well Water (used for irrigation) Soil	25 25 25	DRY During Summer					
2.a. Taraya (TRY)	West		X Residential, Agricultural and Recreational Contributes the Housh Bay Tributary	X		Spring Water (Housh Bay; Recreational Area)	130						

			originating from Housh Bay Water Spring (Roman Ruins)	Well Water 129 (Domestic & Agricultural Use) Housh Bay Tributary 134 (Before WW discharge from Taraya and Chmistar) Housh Bay Tributary 132 (After meeting WW from Taraya and Chmistar)	25.1 7.96 6.91 348 242 170 25.7 7.98 4.24 272 187 176
2.b. Housh Sneid (HSD)		East	X Mainly Agricultural (Wheat, Vegetables and Tobacco Plantation)	Litani R Water 133 (Housh Bay Tributary meeting Litani in Housh Sneid Wastewater Outlet 133 from Housh Sneid Soil 133	29.4 8.46 9.40 516 359 161
3.a. Chmistar (CHM)	West		X X Residential (No source of Domestic Water although Meters were installed 4 to 5 years ago), Agricultural and Small Scale Dairy Plants	None (Not Directly Located along River Bed)	

3.b.Hezeine (HEZ)		East	X X Mainly Agricultural (Tobacco Plantation)	Litani R Water 28 Soil 25 Well Water 26 (Adjacent to river bed) Well water 26 (Main Irrigation Water Source in the Area) Wastewater Outlet 29 (from Hadath Baalbak & Hezeine)	Black Color of Water & Excessive Growth of Bamboo
4.a Bednayl (BDL)	West		X X	Litani R Water 135	DRY During Summer
4.b.i. Housh EL Rafka (HRF)		East	X X	Litani R Water 128	(Mostly dry, No Algae Growth, only Lavender and Bamboo; And Stagnating Sewage from Hosh Rafka and Sifri)
4.b.ii. Sifri (SFR)		East	X X All Water Springs are Dry Main Well Closed by Government	None (Not directly located along River Bed)	

			Wastewater Tapped for Agricultural Use (Sanitary Sewer not Completed and Cesspools are Still in Use)		
5.a. Temnine Al Fawka	West		X X Contributes the Temnine Tributary originating from Jeb el Habach (Roman Ruins) Water Spring is fed by Rain and Snow melting from Neha Area	Spring Water 138 Well Water 138 (Adjacent to Spring; Domestic and Agricultural Use)	Dry In Summer
5.b. Temnine EL Tahta (TMT)		East	X X X Major Rock-Cutting Industry	Temnine Tributary 137 (Dry) Litani R Water 136 Dry River Bed (Meeting point of Temnine Tributary & Litani River) Industrial Wastewater 136 (Rock Cutting Industry)	DRY During Summer DRY During Summer
6.a.i. Ablah (ABL)	West		X X X Plastic Industry and Poultry Processing Plant)	Litani R Water 42 (River Water Mixed with Tanmeyah WW) Domestic Wastewater 39	 Under Construction

				Sanitary Sewer (Ablah WW Treatment Plant)	
6.a.ii. Fersol (FRZ)	West		X X X Contributes the Habbis/Fersol Tributary Originating from Habbis Water Spring	Spring Water 33 Soil 33 (Adjacent to Spring) Habbis Tributary 34 Litani R Water 36 (Meeting point with Habish Tributary) Soil 36 (Adjacent to River) Treated Wastewater 38 Effluent (WW Treatment Plant) Industrial Wastewater 32 (Master Chips)	DRY During Summer Industry is Fenced and Discharge could not be Accessed
6.b. Rayak (RYK)		East	X X Lebanese Army Troops Barraks and Residential Units	Hala River 41 (before joining Litani River) Hala River 41	DRY During Summer Point could not be located (Construction Site

				(joining Litani River) Litany R Water 40 (Rayak Bridge, After Meeting Hala River and before Tanmeyah Industry Discharge) Soil 40	disposing construction Wastes in River Bed) DRY in Summer
7. Yah foufa (YHF)		East	X X And Recreational Areas Contributes the Yahfoufa/ Hala Tributary Originating from Yahfoufa (Jowsha Spring) Tributary is Exposed to WW from Sergaia (Mohafazat Al Zabadani in Syria)	Spring Water 127 (1st Accessible Point) Hala /Yahfoufa 127 River	17.1 8.22 6.29 410 284 113
8. Janta (TNT)		East	X X And Recreational Areas	Hala /Yahfoufa 126 River in Janta	DRY During Summer
9.Masa (MAS)		East	X X	Hala /Yahfoufa 125 River in Masa	DRY During Summer

3.2. THE ORANGE ZONE (MIDDLE)

Table 4: The codes of Cities and Villages Surveyed in the Orange Zone of the Upper Litani Basin

AMR	Amriyeh	عمرية
ANJ	Anjar	عنجر
CHT	Chtaura	شتورة
DLM	Dalhamieyieh	دلهمية
DRZ	Deir Zanoun	دير زنون
FAR	Faour	فاعور
HHR	Housh Al Harimi	حوش الحريمة
HZT	Hazerta	حزرتة
JAL	Jalala	جلالا
JDT	Jdeita	جديتا
MRJ	Marej	مرج
QRM	Qaa Al Rim	قاع الريم
SDL	Saadnayel	سعدنيال
TNL	Taanayel	تعنايل
ZHL	Zahle	زحلة

Table 5: Orange Region Point and Nonpoint Sources of Pollution

Litani River Upper Basin	**Location to River Basin**		**Profile of Village/City**			**Major Sources of Pollution** **Type of Source**		**GPS Reference**
Village/ City	**West**	**East**	**Residential**	**Agricultural**	**Industrial**	**Point Sources**	**Non-Point Sources**	
1.a.i Qaa El Rim/ Hazerta (QRM)	West		X	X	X Contributes to the Litani River the Berdawni Tributary that Originates from Qaa El Rim Springs	Industrial Wastewater (Rim Bottling Industry) Industrial Wastewater (MEMOSA Paper Industry) Hizerta Sanitary Sewerage	Agriculture Run-off	54 54a 57
1.a.ii. Zahle (ZHL)	West		X	X	X And Recreational and Commercial Area	Domestic Wastewater Discharge Site by Berdawni Tributary Wastewater Discharge into Berdawni Tributary from Landfill Leachate Projected Wastewater Treatment Plant Discharge Effluent	Agriculture Run-off	59 61 61

1.a.iii Amriyeh (AMR)	West		X Mainly Residential and Commercial Contributes to the Litani River the Chtoura Tributary that originates from the Jdeita Spring and the Chtoura Spring	Wastewater Discharge (Could not be identified as it is completely Tapped for Irrigation		
2.a.i. Jdeita (JDT)	West		X X Mainly Residential with Small Scale Industries (Dairy Plants, Serum Industry and Mills) Contributes to the Litani River the Chtoura Tributary that originates from Jdeita and Chtoura Springs	Jarjoura Industrial Wastewater	Agriculture Run-off	68
2.a.ii. Chtaura (CHT)	West		X X Mainly Residential and Commercial Contributes to the Litani River the Chtoura Tributary that originates from Jdeita Spring and Chtoura Spring	Industrial Wastewater (Kassatly Industry)	Agriculture Run-off	71
2..a.iii. Taanayel (TNL)	West		X X Mainly Agricultural Contributes to the Litani River the Chtoura Tributary that originates from the Jdeita and Chtoura Springs	Chtoura Tributary (Meeting Junction of Chtoura Spring Ouflow and Jdeita Spring Outflow to form the Chtoura Tributary		76

3.a.. Jalala (JAL)	West		X X Mainly Residential Contributes to the Litani River the Jalala Tributary that is formed by Storm Water	Wastewater Discharge (Could not be Identified as it is Completely Tapped for Irrigation	Agriculture Run-off	-
1.b.i. Anjar (ANJ)	East		X X And Recreational and Industrial (Arack, Juices, Food Packaging and Aquaculture) Contributes to the Litani River the Ghzayel Tributary that Originates from Anjar and Chamsine Water Springs		Agriculture Run-off	84
1.b.ii. Dier Zanoun (DRZ)	East		X X Contributes to the Litani River the Ghzayel Tributary that Originates from Anjar and Chamsine Water Springs	Domestic Sewerage (Anjar & Majd Al Anjar)	Agriculture Run-off	84

1.b.iii. Housh Al Harimi (HHR)	East		X X Mainly Agricultural Contributes to the Litani River the Ghzayel Tributary that Originates from Anjar and Chamsine Water Springs		Agriculture Run-off	
2.b.i. Faour (FAR)	East		X X Mainly Residential and Agricultural Contributes to the Litani the Faour Tributary Originating from the Faour Springs		Agriculture Run-off & Cesspools	
2.b.ii. Delhameyieh (DLM)	East		X X Mainly Agricultural (Animal Farms) and large Bedouins' Summer Settlements		Agriculture Run-off, Animal Wastes and Cesspools	
North Marj Area (MRJ)		West	X X X Mainly Residential Industrial activities (Esphalt Industry	Solid Waste Dump	Agriculture Run-off Water	78

Table 6: Orange Zone Sample Types and Location

Litani River Upper Basin	Location to River Bed		Profile of Village/City			Proposed Sampling Sites		Quality Indicators for River Sampling Points					
Village/ City	**West**	**East**	**Residential**	**Agricultural**	**Industrial**	**Type of Sample**	**Ref. GPS**	**T⁰C**	**pH**	**DO mg/l**	**CND uS**	**TDS mg/l**	**ORP mV**
1.a.i Qaa El Rim / **Hazerta (QRM)**	West		X	X	X Contributes to the Litani River the Berdawni Tributary that Originates from Qaa El Rim Springs	Spring water 55 (Qaa AL Rim) Wells 56 (Qaa`AL Rim) Industrial 54 Wastewater (Rim Bottling Industry) Industrial 54a Wastewater (MEMOSA Paper Industry) Qaa El Rim 58 Berdawni Tributary		Water is Foamy, Blue in Color with Excessive Algae Growth)					

				Before Flowing through Recreational Area in Zahle and after the Inflow of Hizerta Sewerage and MEMOSA Industrial Wastewater Effluent Soil 58 (Adjacent to Berdawni Tributary) Hizerta Sanitary 57 Sewerage	
1.a.ii. Zahle (ZHL)	West		X X X And Recreational and Commercial Area Contributes to the Litani River the Berdawni Tributary that Originates from Qaa El Rim Springs	Berdawni Tributary 59 after Flowing through Recreational Area in Zahle Wastewater 59 Discharge Site Berdouni Tributary 60 Before	22.3 8.66 7.2 336 258 135 Excessive Growth of Algae , and Minimal Water Flow with Dire Sewerage Discharge 23.3 8.55 7.0 325 246 132 Minimal water flow

				Zahle Landfill Wastewater 61 Discharge into Tributary from PEPPSI and Landfill Leachate Projected 61 Wastewater Treatment Plant Soil 61 (Adjacent to Berdawni Tributary)	
1.a.iii. Amriyeh(AMR)	West		X X With Bedouins' Summer Settlements Contributes to the Litani River the Berdawni Tributary that Originates from Qaa El Rim Springs	Berdouni Tributary 62 Well Water 63 (Adjacent to Berdawni Tributary; Domestic Use and Also Used for Washing Fruits and Vegetables before	Dry During Summer (Completely Tapped for Irrigation Use Before Meeting the Chto Tributary in the Marj Area)

				Packaging)	
2.a.i. Jdeita (JDT)	West		X X Mainly Residential (Lebanese Army Barraks) Small Scale Industries (Dairy plants, Serum Industry and Mills) <u>Contributes to the Litani River the Chtoura Tributary that originates from Jdeita and Chtoura Springs</u>	<u>Spring Water</u> 65 (Jdeita) <u>Jdeita Outflow</u> 65 <u>Well Water</u> 65 (Behing Jarjoura Dairy Plant; Supplies Water to 9 Neighboring Villages <u>Well Water Irrigation</u> 67 Canal (Flows into Chtoura Tributary) <u>Jarjoura Industrial</u> 68 Wastewater Effluent <u>Jdeita Outflow</u> 68 after Discharge of Industrial Wastewater <u>Soil</u> 68	DRY During Summer DRY During Summer Clear Water, Minimal Water Flow

2.a.ii.. Chtoura (CHT)	West		X X Mainly Residential and Commercial Contributes to the Litani River the Chtoura Tributary that originates from the Jdeita and Chtoura Springs	Spring Water 69 (Chtoura) Surface Water 70 (Chtoura Outflow Before Meeting the Jdeita Water Outflow to Form the Chtoura Tributary) Industrial Wastewater 71 (Kassatly Industry) Surface Water 72 (Chtoura Outflow)	15.5 8.13 7.28 365 252 130 Dry Completely Tapped for Irrigation Before Joining the Jdeita Spring Outflow to Form the Chtoura Tributary
2..a.iii. Taanayel (TNL)	West		X X X Mainly Residential and Agricultural (Animal Farms) Contributes to the Litani River the Chtoura Tributary that originates from the Jdeita and Chtoura Springs	Chttoura Tributary 76 (Meeting Junction of Chtoura Spring Ouflow and Jdeita Spring Outflow to form the Chtoura Tributary	24.3 7.58 1.88 564 394 108 Turbid Water with Minimal Flow and Minimal Algae Growth (Presence of Turtles, Fish, Water Snakes and Tadpoles)
3.a. Jalala	West		X	Jalala Tributary	Dry In Summer

(JLL)			Mainly Residential Contributes to the Litani River the JalalaTributary that is Formed by Storm Water	86	
1.b.i. Anjar (ANJ)	East		X X And Recreational Industrial Activities (Arack, Juices, Food Packaging and Aquaculture) Contributes to the Litani River the Ghzayel Tributary that Originates from Anjar and Chamsine Water Springs	Spring Water 79 (Anjar Spring) Spring Water 80 (Chamsine Spring) Ghzayel Tributary 82 Soil 82	19.4 5.57 4.04 440 305 118
1.b.ii. Dier Zanoun (DRZ)	East		X X And Bedouins' Summer Settlements Contributes to the Litani River the Ghzayel Tributary that Orriginates from Anjar and Chamsine Water Springs	Domestic Sewerage 84 (Anjar & Majd Al Anjar) Ghzayel Tributary 84 After discharge of Sewage	Mainly Stagnating Sewage

1.b.iii.Horsh Al Harimi (HHR)	East		X X Mainly Agricultural Contributes to the Litani River the Ghzayel Tributary that Orriginates from Anjar and Chamsine Water Springs	Litani R Water 85 (Meeting Junction of Ghzayel Tributary With Litani River After meeting with Berdouni, Chtoura and Jalala Tributaries)	24.3 8.22 6.8 312 220 132
2.b.i. Faour (FAR)	East		X X Mainly Residential and Agricultural Contrbutes to the Litani the Faour Tributary Originating from the Faour Spring	Water Spring 81 (Faour)	
2.b.ii. Delhameyieh (DLM)	East		X X Residential and Large Bedouins' Summer Settlements Mainly Agricultural(Animal Farms)	Faour Tributary 140 Litani R Water 139 (After Meeting with Faour Tributary)	DRY in Summer DRY in Summer
North Marj Area		West	X X X Mainly Residential Industrial Activities (Esphalt Industry	Chtoura Tributary 73 Before & Meeting Berdawni Tributary in Al Marj	Excessive Algae Growth DRY In Summer 19.4 5.57 6.70 325 210 118

				Chtoura & 77 Berdawni Tributary Litani R Water 75 Meeting Point of Chtoura and Berdawni Tributaries in Marj Area Litani R Water 78 Before Meeting Tributaries in Marj Area Litani R Water 74 After meeting Chtoura, Berdawni & Jalala and Before meeting with the Ghzayel	Green Water with Minimal Water Flow Black Color of Water & Excessive Growth of Bamboo Black Color of Water & Excessive Growth of Bamboo

3.3. THE GREEN ZONE (LOWER)

Table 7: The Codes of Cities and Villages Surveyed in the Green Zone

AMQ	Ammiq	عميق
ATN	Aitaneit	عيتانيت
AZB	Ain Zebdeh	عين زبدة
BAL	Baaloul	بعلول
BMR	Bab Merea	باب مارع
DAZ	Deir Ain El Jawzeh	دير عين الجوزة
GHZ	Ghazza	غزة
JBJ	Jib Jenine	جب جنين
KBL	Kobb Elias	قب الياس
KML	Kamed El Louze	كامد اللوز
KNF	Kherbit Kanafar	خربة قنفار
LAL	Lala	لالا
LUC	Luci	لوسي
MAN	Mansoura	منصورة
QRN	Quaroan	قرعون
SGB	Soghbeine	صغبين
TLA	Tal Akhdar	تل أخضر

Table 8: Green Zone Point and Nonpoint Sources of Pollution

Litani River Upper Basin	**Location to River Basin**		**Profile of Village/City**			**Major Sources of Contaminants** Type of Source		**GPS Reference**
Village/ City	**West**	**East**	**Residential**	**Agricultural**	**Industrial**	**Point Sources**	**Non-Point Sources**	
1.a. Kobb Elias (KBL)	West		X Mainly Residential Contributes to the Litani River the Jair, Hafir and Habsiyeh Tributaries Originating from the Ras Al Ain Water Springs	X	X	Domestic Wastewater Discharge	Agricultural Rrunoff	88
1.a.ii. Tal Al Akhdar (TLA)	West		X Mainly Agricultural	X			Agricultural Runoff	
1.a.iii. Ammiq & Housh Ammiq & South of Marj Area (AMQ)	West		X Mainly Agricultural (Seasonal Vegetables) Residential In addition to Bedouns' Settlements Industrial (SICOMO Paper Industry	X	X	Wastewater (Main Sewer from Kobb Elias & Maksi Industrial Wastewater (SICOMO Industry)	Agriculture Runoff	90 91

			PETCO Plastic Industry & Cement,Ceramic Industries) Sanitary Sewerage connected to Jeb Janine WW Treatment Plant			
2.a. Mansoura (MAN)	West		X X Mainly Residential	Wastewater Discharge	Agriculture Runoff	95
2.a.i. Ghazza (GHZ)		East	X X Mainly Residential Area in addition to Bedouns' Settlements	Wastewater (Main Sanitary sewer from Luci, Ghazza & Mansoura)		105
2a.ii. Luci/ Sultan Yaakoub/ (LUC)		East	X X Mainly Agricultural (Fruits and Vegetables)		Agriculture Runoff & Cesspools	
3.a.i Kherbit Kanafar (KNF)	West		X X And Recreational Sewerage network not yet connected (Depend on Cesspools and Septic Tanks)		Agriculture Runoff & Cesspools	
3.a.ii. Ain Zebdeh (AZB)	West		X X Mainly Residential Agricultural (Fruits & Olives) & Trout Fish Aquaculture		Agriculture Runoff	

3.b.i. Jeb Jenine (JBJ)		East	X X Mainly Residential (Upper Part) Agricultural (Seasonal Vegetables; Lower Part Irrigated by Litani Canal 900)	Domestic Wastewater (Jeb Jenine & Kamed Al Louze) Wastewater Treatment Plant (Under Construction)	 Agriculture Runoff	110 110
3.b.ii. Kamed Al Louze (KML)		East	X X Mainly Residential (Upper Part) Agricultural (Seasonal Vegetables; Lower Part Irrigated by Litani Canal 900)		Agriculture Runoff	
4.a.. Sagbeine (SGB)	West		X X X Mainly Residential and Small Scale Industries (Sugar Cane, & Ceramics)	Wastewater Treatment plant Located directly by the Quaroun Lake (Under Construction) Solid Wastes Dump Site	 Agriculture Runoff	123 119
4.b. Lala (LAL)		East	X X (Agricultural; Gets Irrigation Water from Canal 900) And Stone Cutting Industry	Stone Cutting Industry		112
5.a.i. Dial Ain Al Jaozeh (DAZ)	West		X X Mainly Residencial		Agriculture Runoff	

5.a.ii. Bab Marea (BMR)	West		X X Mainly Residencial	Wastewater Treatment Plant (Under Construction and directly along the Quaroun Lake Side; WW from Sabbeine, Ain Al Jaoze, Bab Marea & Aitaneit)	Agriculture Runoff	123
5.b. Baaloul (BAL)		East	X X Mainly Residential Gets Irrigation Water from Canal 900		Agriculture Runoff	
6.a. Aitaneit (ATN)	West		X Mainly Residential; Directly on the Lake (Wastewater Channeled to Wastewater Treatment Plant in Bab Marea	Wastewater Treatment Plant (Under Construction and Directly along the Quaroun Lake Side) WW from Sabbeine, Ain Al Jaoze, Bab Marea & Aitaneit)		123
6.b. Qaroun (QRM)		East	X ainly Residential And Recreational; Directly on the Quaroun Lake Contributes to the lake major water Springs of Ain El Deir, Ain Al Jamea, Ain Barada, Ain El Harf and Ain El Diaa	Recreational Areas Along Qaroun Lake		118

Table 9: Green Region Sample Types and Location

Litani River Upper Basin	**Location to River Bed**		**Profile of Village/City**			**Proposed Sampling Sites**		**Quality Indicators for River Sampling Points**					
Village/ City	**West**	**East**	**Residential**	**Agricultural**	**Industrial**	**Type of Sample**	**Ref. GPS**	**T⁰C**	**pH**	**DO mg/l**	**CND uS**	**TDS mg/l**	**ORP mV**
1.a. Kobb Elias (KBL)	West		X Mainly Residential Contributes to the Litani River the Jair, Hafir and Habsiyeh Tributaries Originating from the Ras Al Ain Water Springs	X		Spring Water (Ras Al Ain) Surface water (Habsieyeh Tributary) Surface Water (Junction Point of Habasieyeh, Jair and Hafir Tributaries)	87 88 89	DRY in Summer DRY in Summer					
1.a.ii. Tal al Akhdar (TLA)	West		X Mainly Agricultural	X		Surface Water (Junction Point of Habasieyeh, Jair and Hafir Tributaries befor Meeting the Litani river in Hosh Ammiqe, South al Marj)	93	DRY (Stagnating Wastewater)					
1.	West		X	X	X	Litani R Water	90	DRY in Summer					

Ammiq & Housh Ammiq & South of Marj Area (AMQ)			Residential in addition to Bedouns'Summer Settlements Agricultural (Mainly Vegetables) Industrial (SICOMO Paper Industry PETCO Plastic Industry & Cement,Ceramic Industries) Sanitary Sewerage Connected to Jeb Janine WW Treatment Plant	(Hafir, Jair & Habasiyeh Tributaries joining Litani River Wastewater 90 (Main Sewer from Kobb Elias & & Maksi Pouring into the Habasieyeh Tributary) Soil 90 (Irrigated by WW) Industrial Wastewater 91 (SICOMO Industry) Soil 92 (Irrigated by Industrial Wastewater)	
2.a. Man soura (MAN)	West		X X Mainly Residential	Litani R Water 95 (before discharge of WW from Luci, Ghazza & Mansoura) Soil 95 Well Water 95	28.5 8.09 7.53 540 376 121 Excessive Algae Growth (fish, ducks, water snakes, turtles…)

				(Domestic & irrigation Use)	
2.a.i. Ghazza (GHZ)		East	X X Residential Area Mainly in addition to Bedouins' Settlements	Litany R Water 95 (before discharge of WW from Luci, Ghazza & Mansoura) Wastewater 105 (Main Sewer from Luci, Ghazza & Mansoura) Soil 105 (Irrigated with WW)	28.5 8.09 7.53 540 376 121 Excessive Algae Growth (fish, ducks, water snakes, turtles…)
2a.ii. Luci/ Sultan Yaakoub (LUC		East	X X Mainly Residential And Agricultural (Fruits and Vegetables)	Litany R Water 104 None (Not directly located along River Bed) Well Water 104 (2 main wells) (Supplies water to Khiera, Ghazza, Mansoura & luci)	
3.a.i Kherbit Kanafar (KNF)	West		X X And Recreational Sewarage network not yet connected (depend on cesspools and Septic Tanks)	Litany R Water None (Not directly located along River Bed) Spring Water 96 (Nabeh EL Khreizat)	

3.a.ii. Ain Zebdeh (AZB)	West		X X Mainly Residential Agricultural (Fruits & Olives) & Trout Fish Aquaculture	None (Not directly located along River Bed) Spring Water 98 (Nabeh EL Sabeh Aayoun) Spring Water 99 (Nabeh EL Asafir)	
3.b.i. Jeb Jenine (JBJ)		East	X X Mainly Residential (Upper Part) Agricultural ((Vegetables; Lower Part and irrigated by Litani Canal 900)	Litany R Water 108 (After Discharge of WW from Luci, Ghazza & Mansoura) Soil 108 Domestic Wastewater 110 (Main Sewer from Jeb Jenine & Kamed Al Louze; not accessible WW Treatment Plant Under Construction) Well Water 111 (Adjacent to River; Domestic & Irrigation Use)	27.5 7.99 7.63 510 356 120

				Soil 111 (Adjacent to Well)	
3.b.ii. Kamed Al Louze (KML)		East	X X Mainly Residential (Upper Part) Agricultural (Seasonal Vegetables; Lower Part and Irrigated by Litani Canal 900)	None (Not directly located along River Bed) Well Water 106 (Domestic Use)	
4.a.. Sag beine (SGB)	West		X X X Mainly Residential Small scale industries(Sugar Cane, & Ceramics)	Spring Water 100 (Sagbeine Water Spring; 1st accessible point under Bridge) Spring Water 101 (Ain Al Tayoun) Domestic 101 Wastewater Feeding into Spring Water Spring Water Ain Al Remeil; Domestic and Irrigation Water) Llitani R Water 119 (End Point Before Flowing into Quaroun Lake)	DRY in Summer
4.b. Lala		East	X X	None (Not directly	

(LAL)			Agricultural; Gets irrigation Water from Canal 900 Industrial; Stone Cutting Industries	located along River Bed) <u>Well Water</u> 112 (Not accessible due to cut off in electricity)	
5.a.i. Ain Al Jaozeh (DAZ)	West		X X Mainly Residencial Oversees the Qaroun Lake	<u>Spring Water</u> 103 (Ain Al Jaozeh; Domestic Water)	
5.a.ii. Bab Marea (BMR)	West		X X Mainly Residencial Oversees the Qaroun Lake	<u>Spring Water</u> 120 (Bab Marea; Domestic Water)	
5.b. Baaloul (BAL)		East	X X Mainly Residencial Agricultural; Gets Irrigation Water from Canal 900	<u>Spring Water</u> 114 (Ain Al Tout; Blue Water Project to Supply Domestic Water to Mushgarah) <u>Well Water</u> 116 (Domestic Use)	
6.a. Aitaneit (ATN)	West		X X Mainly Residential; Directly on the Lake (wastewater chanelled to wastewater Treatment Plant in Bab Marea	<u>Spring water</u> 121 <u>(Ain Al Dob)</u>	

6.b. Qaroun (QRM)		East	X X Mainly Residential and Recreational; Directly on the Lake Contributes to the Lake Major Water Springs of Ain El Deir, Ain Al Jamea, Ain Barada, Ain El Harf and Ain El Diaa	Spring water 117 (Ain Al Diaa) Well Water 118 (By the Lake; Domestic and Irrigation Uses)	

3.4. GPS DATA

Reference	Elevation (m)	North	East
20	1021	34°01.787	36°04.563
21	1020	34°01.787	36°04.563
22	1019	34°01.778	36°04.861
23	1019	34°01.796	36°04.844
24	1015	33°59.640	36°06.357
25	997	33°58.831	36°04.831
26	994	33°58.795	36°05.066
27	1019	33°58.198	36°06.310
28	983	33°57.966	36°04.775
29	987	33°58.249	36°04.810
30	1009	33°58.133	36°05.519
31	1014	33°58.133	36°05.519
32	940	33°51.455	35°56.538
33	1096	33°53.274	35°56.382
34	945	33°51.585	35°57.042

36	906	33°50.418	35°57.817
37	918	33°51.689	35°57.370
38	913	33°50.979	35°57.389
39	912	33°51.334	35°58.640
40	916	33°51.807	35°59.392
41	946	33°51.230	36°00.902
42	911	33°51.319	35°98.725
43	904	33°37.420	35°46.327
44	908	33°37.370	35°46.243
45	914	33°36.867	35°46.327
46	910	33°36.259	35°44.060
47	912	33°35.449	35°43.492
48	955	33°34.463	35°43.578
49	919	33°33.553	35°42.867
50	917	33°32.772	35°42.032
51	917	33°37.716	35°48.333
52	910	33°37.712	35°48.176
53	918	33°37.773	35°47.545
54	1246	33°53.232	35°52.292
55	1254	33°53.154	35°52.283
56	1248	33°53.252	35°52.288
57	1256	33°53.074	35°52.303
58	1099	33°52.154	35°52.873
59	984	33°51.002	35°53.829
60	925	33°49.544	35°54.584
61	892	33°48.047	35°54.777
62	882	33°47.501	35°54.757
63	985	33°49.477	35°50.049

64	877	33°46.586	35°53.287
65	1032	33°49.530	35°49.794
66	1024	33°49.434	35°49.881
67	985	33°49.477	35°50.049
68	934	33°48.791	35°50.538
69	936	33°49.442	35°51.037
70	921	33°48.956	35°51.127
71	888	33°47.056	35°51.577
72	880	33°46.433	35°52.197
73	880	33°46.122	35°52.096
74	882	33°46.037	35°52.622
75	879	33°46.352	35°53.003
76	890	33°47.421	35°51.862
77	879	33°42.753	35°53.467
78	880	33°46.649	35°46.642
79	890	33°43.986	35°56.774
80	880	33°44.651	35°57.412
81	886	33°46.997	35°58.098
82	880	33°45.063	35°56.885
83	882	33°45.150	35°56.236
84	879	33°45.307	35°54.711
85	875	33°43.710	35°49.819
86	921	33°48.974	35°51.700
87	915	33°47.616	35°49.361
88	912	33°47.446	35°49.544
89	889	33°47.325	35°50.743
90	884	33°47.114	35°51.031
91	890	33°45.760	35°48.575

92	877	33°45.403	35°48.347
93	871	33°44.843	35°48.987
94	868	33°40.731	35°48.881
95	868	33°40.786	35°49.098
96	965	33°37.802	35°43.127
97	989	33°37.672	35°42.669
98	972	33°37.679	35°42.742
99	1075	33°37.471	35°42.141
100	1029	33°36.950	35°41.987
101	1019	33°36.693	35°41.937
102	1100	33°36.758	35°41.625
103	966	33°35.818	35°41.506
104	892	33°39.029	35°50.556
105	867	33°40.149	35°49.198
106	930	33°37.541	35°49.516
107	907	33°37.661	35°48.507
108	869	33°38.386	35°46.791
109	871	33°38.200	35°46.706
110	870	33°38.241	33°46.659
111	889	33°37.601	35°46.393
112	930	33°36.489	35°45.360
113	931	33°36.491	35°45.361
114	1171	33°35.432	35°45.198
115	1158	33°35.431	35°45.161
116	1018	33°35.246	35°44.421
117	997	33°33.715	35°43.401
118	968	33°34.591	35°43.681
119	880	33°36.845	35°43.269

120	1003	33°34.868	35°40.815
121	1014	33°34.687	35°40.667
122	947	33°35.411	35°41.257
123	940	33°35.493	35°41.336
124	946	33°51.273	36°01.239
125	974	33°51.170	36°02.446
126	1028	33°51.275	36°05.387
127	1104	33°51.789	36°06.856
128	960	33°55.439	36°02.978
129	1006	33°57.361	36°02.959
130	1010	33°57.654	36°02.423
131	1014	33°57.366	36°02.361
132	1004	33°57.209	36°03.042
133	975	33°56.620	36°03.682
134	1003	33°57.384	36°02.964
135	940	33°53.487	36°01.699
136	926	33°35.760	35°48.575
137	937	33°53.492	35°59.239
138	1097	33°54.607	35°58.665
139	865	33°49.335	35°56.694
140	857	33°47.737	35°57.391
141	891	33°48.230	35°52.605
143	844	33°36.741	35°42.453
145	850	33°36.427	35°42.342
149	848	33°35.997	35°42.033
150	850	33°35.609	35°41.829
151	851	33°35.381	35°41.754
152	852	33°35.244	35°41.806

153	852	33°35.076	35°41.978
154	854	33°34.856	35°41.910
155	855	33°34.621	35°41.876
156	854	33°34.475	35°41.888
157	855	33°34.199	35°41.842
158	855	33°33.852	35°41.768
159	856	33°33.409	35°41.631
160	855	33°32.910	35°41.530
171	1209	33°52.755	35°52.617
172	946	33°51.329	35°56.616
174	1016	33°56.351	36°05.090
176	969	33°53.810	36°02.920
177	946	33°53.154	36°02.071
178	924	33°52.042	36°00.117
179	927	33°50.302	36°00.628
180	944	33°52.203	35°57.914
181	910	33°51.779	35°59.044

4. APPENDIX IV: SAMPLING LOCATIONS

4.1. COMPARISON OF SAMPLING SITES ALONG THE UPPER LITANI BASIN TO SITES SAMPLED BY BAMAS STUDY 2005

Table 10: Comparison of Sampling Sites along the Upper Litani Basin to Sites Sampled by BAMAS 2005 Study and Current Study 2010

Current Study	City/geVilla	BAMAS Sampling Points
Litani R_Water in Saidi	(SAD	None
Litani R Water in Housh Barada	(HB)	None
Housh Bay Tributary Output in Taraya	(TRY)	None
Housh Bay Tributary (Before WW discharge from Taraya and Chmistar)	(TRY)	None
Housh Bay Tributary (After Meeting WW from Taraya & Chmistar)	(TRY)	None
Litani R Water (Housh Bay Tributary meeting Litani in Housh Sneid	(HSD)	None
Litani R Water in Hezeine	(HEZ)	None
Litani R Water in Bednayl	(BDL)	Litani, Downstream Bednayel WW
Litani R Water in Housh El Rafka LRBMS_WATER QUALITY SURVEY VOLUME 2	(HRF)	Litani River, Downstream WW Houch EL Litani River, Upstream WW Houch EL Rafq
Temnine Tributary Output Originating from Jeb EL Habach Spring mnine e (AlL FawkaT	(TAF)	None

Temnine Tributar	(TMT)	None
Litani R Water Dry River Bed Meeting Point of Temnine Temnine Tributary & Litani Rive	(TMT)	Litani River, Downstream WW of Tamnine Tahta and Fawqa Bridge Over Litani River on Road from Temnin Tahta to Baalbeck Highway
Litani R Water (River Water Mixed with Tanmeyah WW) Ablah	(ABL)	Litani River, Downstream Ablah WW and Tanmiya Discharge
Habbis/Ferzol Output Originating from Habbis Spring Water	(FRZ)	None
Habbis Tributary in Ferzol Not Applicable as WW is Channeled to treatment plant in Ferzol	(FRZ)	None Litani River, Downstream Ferzol WW
Litani R Water (Meeting point with Habasieh Tributary)	(FRZ)	None
Hala River (before joining Litani River) Rayak	(RYK)	None
Hala River Joining Litani River	(RYK)	Joint of Hala River with Litani
Litany R Water (Rayak Bridge, After Meeting Hala River and Before Tanmeyah Industry Discharge)	(RYK)	Litani River, After Riyak Bridge, Before Tanmiya Metal Bridge Over Litani River Downstream of Tanmiya
Yahfoufa/Hala Output Originating from Yahfoufa (Jiwsha) Spring (1st Accessible Point)	Yahfoufa (YHF)	None

Hala /Yahfoufa River	(YHF)	None
Hala /Yahfoufa River in Janta	(TNT)	None
Hala /Yahfoufa River in Masa	(MAS)	None
Berdawni Tributary Output Originating from the Qaa El Rim Springs	(QRM)	Berdouni River, Upstream of 2WR108
Berdawni Tributary Before Flowing through Recreational Area in Zahle and After the Inflow of Hizerta Sewerage and MEMOSA Industrial Wastewater Effluent	(QRM)	Point is near Muntazah Wadi El Rim on Berdouni River Downstream of Mimosa Factory Berdouni River, Downstream of Wastewater Discharge at 2WR107 Near the Dumpsite
Berdawni Tributary after Flowing through Recreational Area in Zahle	(ZHL)	None
Berdouni Tributary Before Zahle Landfill	(ZHL)	None

Berdouni Tributary (After Landfill)	(AMR)	Litani River, Downstream Zahle Landfill Bridge Over Berdouni in Zahle after crossing Zahle - Baalbeck Road (Downstream of 2WR099) Bridge over Berdouni River Downstream of 2WR103 close to Electrical Power plants Berdouni River, Downstream of 2WR106, and Upstream of 2WR107 Berdouni River, Downstream of 2WR108 Point is on Litani River Downstream of Landfill Site Before Entering Barelias Area
Jdeita Outflow from Spring	(JDT	None
Jdeita Outflow	(JDT)	None
Jdeita Outflow After Discharge of Industrial Wastewater	(JDT)	None
Originating Chtoura Output from Spring Water	(CHT	Chtaura Spring Source
Chtoura Outflow Before Meeting the Jdeita Water Outflow to Form the Chtoura Tributary	(CHT)	Chtaura River Before Joint with Berdouni Chtaura River, Upstream of 2WR078?????
Chtoura Outflow	(CHT)	Bridge over Chtaura river downstream of 2WR069 Bridge Over Litani River on Chtaura El Marj Road Chtaura River, Refore Wastewater - Masabki Hotel
Jalala Tributary	(JLL)	Bridge Over Combined Flow of Chtaura River and Jalala River Before

		Dayr Taanayel Area????
Anjar Outflow from Spring	(ANJ)	Anjar Spring behind MoA Fisheries
Chamsine Output from Spring	(ANJ)	Chamseine Spring
Ghzayel Tributary	(ANJ)	None
Ghzayel Tributary After Discharge of Sewage Dier Zanou	(DRZ	Ghzayyel River, Downstream of 2WR117 and 2WR118 Bridge Over Ghzayyel (or referred to as Dayr Zanoun) Between Bar Elias and Anjar Ghzayyel River, Downstream of 2WR118(WW Discharge of Barelias are that could not be sampled since pipe is embedded in flow channel) and upstream of 2WR117
Litani R Water(Meeting Junction of Ghzayel Tributary With Litani River After Meeting with Berdouni, Chtoura and Jalala	Horsh AL Harimi (HHR)	Litany River, Upstream Ghzayel Joint Litany River, Downstream Ghzayel Joint
Tributary originating from Faour Springs	(FAR)	None
Faour Tributary before meeting Litani River in Delhameyeieh	DLM	None

Litani R Water (After Meeting with Faour Tributary in Dalhameyieh) and after Industrial Zone in Zahleh	(MLD)	Bridge Over Litani River on Dalhamiye - Karak Road Dalhamiye Bridge Over Litani - Downstream is Bridge Over Litani from Industrial Area in Zahle towards Faour, and Upstream is Bridge 2WR156 Over Litani after Junction with Hala River)
Chtoura & Berdawni Tributaries	North Marj Area	Berdouni River Joint with Chtaura
Litani R Water Meeting Point of Chtoura & Berdawni Tributaries	North Marj Area	Berdouni/Chtaura Combined Flow Joining Litani River at this Spot
Litani R Water Before Meeting Tributaries in Marj Area	North Marj Area	None
Litani R Water After meeting Chtoura, Berdawni & Jalala and Before Meeting with the Ghazyel	North Marj Area	Bridge over Litani River, Downstream of Junction Between Combined Chtaura/Berdouni River, and Litani River
Habasieyeh, Hafir and Jair Outflow from Ras Al Ain Spring	Kobb Ellias (KBL)	Spring in Qobb Elias
Habsieyeh Tributary	(KBL)	Makssi Rive r
Surface Water Hafir and Jair Tributaries	(KBL)	None
Junction Point of Habasieyeh, Jair and Hafir Tributaries before Meeting the Litani river in Hosh Ammiqe, South al Marj	Tal al Akhdar (TLA)	None
Junction Point of Habasieyeh Jair and Hafi Tributaries Joining the Litani River SICOMO was tapped completely for irrigation at the source	Ammiq & Housh Ammiq & South Marj (AMQ)	Litani River - Before Joint with Combined Flow of Hafir/Gair River? Litani River After Joint with Hafir/Gair Combined Flow Hafir river, Downstream of WW Discharge and Sicomo Effluent - in Tal Akhdar Area

Litani R (Before Discharge of WW from Luci Ghazza & Mansoura)	(MAN)	Bridge Between Mansoura and Ghazze (location is Before Ghazze and Louce WW discharge on Litani, and after Ghazze Waste Disposal Site)
Litani R Water in Ghazza	(GHZ)	Bridge between Mansoura and Ghazza (Location is Before Ghazza and Louce WW Discharge on Litani, and after Ghazze Waste Disposal site)
Litany R Water(After Discharge of WW of WW from Luci, Ghazza & Mansoura	Jeb Jenine (JBJ)	Jib Jannine Bridge - Point is after Kamed el Louz Wastewater Discharge Point, and Before Jib Jannine Wastewater Discharge Point
Litani R Water After Discharge of Main Sewer from Jeb Jenine & Kamed Al Louze; not accessible (construction site in progress)	(JBJ)	Litani River, Downstream Jib Jannine WW Outlet
Ain al Tayoun Spring in Sagbeine	(SGB)	Outflow in Soghbeine
Ain El Deb Spring in Aitaneit	(ATN)	Ain El Deb Outflow
Bab Marea Spring	(BMR)	None
Ain El Tout Spring Ain ElTou inBaaloul	(BAL)	None
Sabeh Aayoun Spring & Nabeh EL Asafir Spring in Ain Zebdeh	(AZB)	None
Ain Al Jaozeh Spring	Ain Al Jaozeh (DAZ)	None
Ain Al Dayaa	Qaroun (QRN)	None
Amiq Wetland		Earthen Canal Discharging Ammiq Swamp Water - (called Nahr el Riyashi), Agricultural Drainage, and other Tributaries fom Tal el

Access not Allowed	(AMQ)	Akhdar, and Kab Elias Area
Not Identified		Point on Zebdol River
Not Identified as the code is not indicated in BAMAS Tables		Bridge over Litani River Behind El Tal, Upstream of 2WR134
Not Identified as the code is not indicated in BAMAS Tables		Bridge Over Litani River Downstream of 2WR145 and just Upstream of 2WR140
Not Identified as the code is not indicated in BAMAS Tables		Point is on Hafir River Downstream of all Qabelias WW discharge (Upstream of 2WR176, and Downstream of 2WR177)
Not Identified as the code is not indicated in BAMAS Tables		Litany River, Downstream 2WR051
Not Identified as the code is not indicated in BAMAS Tables		Litani River, Downstream 2WR109 and Upstream 2WR113
Not Identified as the code is not indicated in BAMAS Tables		Litani River, Upstream 2WR211 and Downstream 2WR169
Not Identified as the code is not indicated in BAMAS Tables		Litani River, after Chmistar WW
Not Identified as the code is not indicated in BAMAS Tables		Litani River, Downstream 2WR224
Not Identified as the code is not indicated in BAMAS Tables		Mekse River, Downstream of WW at 2WR055
Not Identified as the code is not indicated in BAMAS Tables (Jdeita Tributary flow to Chtaura Tributary and not Mekse)		Jdita River, Upstream of joint of Mekse and Jdita
Not Identified as the code is not indicated in BAMAS Tables (Identified as Habassiyyeh River)		Qab Elias River, After leaving Residential Street near LRA Station

4.2. TYPES AND CORRESPONDING NUMBER OF WATER, SOIL AND SEDIMENT SAMPLES

Table 11: Types and Corresponding Number of Water Soil and Sediment Samples

Type of Sample	Total Number of Samples			Quality Analysis Indicators	
	Proposed	Sampled	Dry/Inaccessible	Type I- Full Analysis	Type II- Metal Analysis (20% of Samples)
River Water **Lake Water** **Canal Water** **Industrial Wastewater** **Domestic Wastewater**	50 15 5 20 10	50 10 7 7 17	24	▪ pH ▪ EC ▪ Alkalinity ▪ Total coliforms ▪ Fecal coliforms ▪ Fecal Streptococci ▪ Nitrates ▪ Phosphates ▪ Sulfates ▪ Chlorides ▪ Ammonia ▪ Total dissolved solid ▪ BOD ▪ DO ▪ Potassium, Calcium, Magnesium, Sodium ▪ Organochlorines ▪ Organophosphorous	▪ Lead ▪ Mercury ▪ Cadmium ▪ Chromium ▪ Nickel ▪ Copper ▪ Zinc ▪ Iron ▪ Aluminum ▪ Arsenic ▪ Barium ▪ Cobalt ▪ Boron ▪ Manganese ▪ Molybdenum
Groundwater Springs Wells	30	48 22 26	 4 1	Same as above	Same as above

Type of Sample	Total Number of Samples			Quality Analysis Indicators	
	Proposed	Sampled	Dry/Inaccessible	Type I- Full Analysis	Type II- Metal Analysis (20% of Samples)
Soil River Sediments Lake sediments	50 - 5	35 6 4		▪ pH ▪ EC ▪ Total organic carbon ▪ Nitrates ▪ Phosphates (Olson-extractable P) ▪ Sulfates ▪ Chlorides ▪ Ammonia ▪ water soluble cations (Ca, Mg, K and Na) ▪ Sieve analysis	Same as above

4.3. SAMPLE CODES

Surface Water - SRF

Serial No.	C	S	Sample	Village	Ref.	Elev.	North	East	Photo ID
001	YU	SS	RF	SAD	20	1021	34°01.787	36°04.563	2165 - 2166
002	YU	SS	RF	HWB	25	997	33°58	36°04	2176
003	YU	SS	RF	HEZ	28	983	33°57.966	36°04.775	2182 & 2184
004	YU	SS	RF	FRZ	34	945	33°51.585	35°57.042	2195
005	YU	SS	RF	FRZ	36	906	33°50.418	35°57.817	2196 - 2202
006	YU	SS	RF	RYK	41	946	33°91.230	36°00.902	2217 - 2218
007	YU	SS	RF	ABL	42	911	33°51.319	35°98.725	2220 - 2231
008	OU	SS	RF	QRM	58	1099	33°52.154	35°52.873	2471-2474
009	OU	SS	RF	ZHL	59	984	33°51.002	35°53.829	2477-2478
010	OU	SS	RF	ZHL	60	925	33°49.544	35°54.584	2479
011	OU	SS	RF	AMR	62	882	33°47.501	35°54.757	2486-2489
012	OU	SS	RF	JDT	65	1032	33°49.530	35°49.794	2503-2504
013	OU	SS	RF	JDT	63	985	33°49.477	35°50.049	2409
014	OU	SS	RF	JDT	68	934	33°48.791	35°50.538	2510
015	OU	SS	RF	CHT	70	921	33°48.956	35°51.127	2516-2520
016	OU	SS	RF	CHT	72	880	33°46.433	35°52.197	2524
017	OU	SS	RF	MRJ	73	880	33°46.122	35°52.096	2525-2527

0	1	8	O	U	S	S	R	F	M	R	J	74	882	33°46.037	35°52.622	2529
0	1	9	O	U	S	S	R	F	M	R	J	75	879	33°46.352	35°53.003	2531-2534
0	2	0	O	U	S	S	R	F	T	N	L	76	890	33°47.421	35°51.862	2539
0	2	1	O	U	S	S	R	F	M	R	J	77	879	33°42.753	35°53.467	2541-2546
0	2	2	O	U	S	S	R	F	M	R	J	78	880	33°46.649	35°46.642	2547-2549
0	2	3	O	U	S	S	R	F	A	N	J	82	880	33°45.063	35°56.885	2562-2564
0	2	4	O	U	S	S	R	F	H	H	R	85	875	33°43.710	35°49.819	2591-2605
0	2	5	O	U	S	S	R	F	J	A	L	86	921	33°48.974	35°51.700	2606-2607
0	2	6	G	U	S	S	R	F	K	B	L	88	912	33°47.446	35°49.544	2700-2702
0	2	7	G	U	S	S	R	F	K	B	L	89	889	33°47.325	35°50.743	2703-2704
0	2	8	G	U	S	S	R	F	A	M	Q	90	884	33°47.114	35°51.031	2706
0	2	9	G	U	S	S	R	F	A	M	Q	90	884	33°47.114	35°51.031	2708-2709
0	3	0	G	U	S	S	R	F	T	L	A	93	871	33°44.843	35°48.987	2714
0	3	1	G	U	S	S	R	F	M	A	N	95	868	33°40.786	35°49.098	2718-2723
0	3	2	O	U	S	S	R	F	D	R	Z	84	879	33°45.307	35°54.711	2569-2571
0	3	3	G	U	S	S	R	F	J	B	J	108	869	33°38.386	35°46.791	2754-2757
0	3	4	G	U	S	S	R	F	S	G	B	143	844	33°36.741	35°42.453	2783-2789
0	3	5	Y	U	S	S	R	F	M	A	S	125	974	33°51.170	36°02.446	2816-2818

Spring Water - SPR

Serial No.	C	S	Sample	Village	Ref.	Elev.	North	East	Photo ID
001	YU	SS	PR	FRZ	33	1096	33°53.274	35°56.382	2186
002	OU	SS	PR	QRM	55	1254	33°53.154	35°52.283	2466
003	OU	SS	PR	CHT	69	936	33°49.442	35°51.037	2514-2515
004	OU	SS	PR	ANJ	79	890	33°43.986	35°56.774	2550-2552
005	OU	SS	PR	ANJ	80	880	33°44.651	35°57.412	2553-2555
006	OU	SS	PR	FAR	81	886	33°46.997	35°58.098	2559-2561
007	GU	SS	PR	KBL	87	915	33°47.616	35°49.361	2699
008	GU	SS	PR	KNF	96	965	33°37.802	35°43.127	2724-2725
009	GU	SS	PR	AZB	98	972	33°37.679	35°42.742	2726
010	GU	SS	PR	AZB	99	1075	33°37.471	35°42.141	2727
011	GU	SS	PR	SGB	100	1029	33°36.950	35°41.987	2729-2731
012	GU	SS	PR	SGB	101	1019	33°36.693	35°41.937	2732-2733
013	GU	SS	PR	SGB	102	1100	33°36.758	35°41.625	2734
014	GU	SS	PR	DAZ	103	966	33°35.818	35°41.506	2738
015	GU	SS	PR	QRN	117	997	33°33.715	35°43.401	2778
016	GU	SS	PR	BMR	120	1003	33°34.868	35°40.815	2799-2800
017	GU	SS	PR	ATN	121	1014	33°34.687	35°40.667	2801-2803

0	1	8	Y	U	S	S	P	R	Y	H	F	127	1104	33°51.789	36°06.856	2826
0	1	9	Y	U	S	S	P	R	T	R	Y	130	1010	33°57.654	36°02.923	2835-2839
0	2	0	Y	U	S	S	P	R	T	M	F	138	1097	33°54.607	35°58.665	2866-2874
0	2	1	O	U	S	S	P	R	S	D	L	141	891	33°48.230	35°52.605	2884-2885
0	2	2	Y	U	S	S	P	R	R	Y	K	179	927	33°50.302	36°00.628	

0	1	8	Y	U	S	W	E	L	R	Y	K	124	946	33°51.273	36°01.239	2814-2815
0	1	9	Y	U	S	W	E	L	T	R	Y	129	1006	33°57.361	36°02.959	2834
0	2	0	Y	U	S	W	E	L	T	R	Y	131	1014	33°57.366	36°02.361	2840
0	2	1	Y	U	S	W	E	L	T	M	F	138	1097	33°54.607	35°58.665	2875
0	2	2	Y	U	S	W	E	L	A	B	L	180	944	33°52.203	35°57.914	
0	2	3	O	U	S	W	E	L	S	A	R	176	969	33°53.810	36°02.920	
0	2	4	Y	U	S	W	E	L	H	E	L	177	946	33°53.154	36°02.071	
0	2	5	Y	U	S	W	E	L	H	E	L	178	924	33°52.042	36°00.117	
0	2	6	Y	U	S	W	E	L	A	B	L	181	910	33°51.779	35°59.044	
0	0	7	O	U	S	W	E	L	Q	R	M	56	1248	33°53.252	35°52.288	2467
0	0	8	O	U	S	W	E	L	A	M	R	63	887	33°48.285	35°54.380	2490
0	0	9	O	U	S	W	E	L	J	D	T	65	1032	33°49.530	35°49.794	2501
0	1	0	G	U	S	W	E	L	M	A	N	94	868	33°40.731	35°48.881	2716-2717
0	1	1	G	U	S	W	E	L	L	U	C	104	892	33°39.029	35°50.556	2743-2745
0	1	2	G	U	S	W	E	L	K	M	L	106	930	33°37.541	35°49.516	2751-2752
0	1	3	G	U	S	W	E	L	K	M	L	107	907	33°37.661	35°48.507	2753
0	1	4	G	U	S	W	E	L	J	B	J	111	889	33°37.601	35°46.393	2763-2764
0	1	5	G	U	S	W	E	L	L	A	L	112	930	33°36.489	35°45.360	2766-2767
0	1	6	G	U	S	W	E	L	B	A	L	116	1018	33°35.246	35°44.421	2776-2777
0	1	7	G	U	S	W	E	L	Q	R	N	118	968	33°34.591	35°43.681	2779-2782

Waste Water - WST

Canal Water

Serial No.	C	S	Sample	Village	Ref.	Elev.	North	East	Photo ID
001	4	CANAL	JBJ		43	904	33°37.420	35°46.327	2239
002	4'	CANAL	JBJ		45	914	33°36.867	35°45.059	2245
003	3	CANAL	BAL		48	912	33°35.449	35°43.492	2250
004	2	CANAL	QRN		49	919	33°33.553	35°42.867	2260
005	1	CANAL	QRN		50	917	33°32.772	35°42.039	2264
006	6	CANAL	KML		51	917	33°37.716	35°48.333	2269
007	5	CANAL	KML		53	918	33°37.773	35°47.545	2271
012	S12	QRNLAK			159	856	33°33.409	35°41.631	
013	S13	QRNLAK			160	855	33°32.910	35°41.530	
012	GUSWSTATN				123	940	33°35.493	35°41.336	2804-2806
013	YUSWSTFRZ				36	906	33°50.418	35°57.817	2196 - 2202
014	YUSWSTABL				42	911	33°51.319	35°98.725	2220 - 2231
015	OUSWSTMRJ				73	880	33°46.122	35°52.096	2525-2527
016	OUSWSTDRZ				84	879	33°45.307	35°54.711	2569-2571
017	YUSWSTTRY				134	1003	33°57.384	36°02.964	2852-2853

Soil - SOL

Serial No.	C	S	Sample	Village	Ref.	Elev.	North	East	Photo ID
001	YU	SS	OL	SAD	22	1019	34°01.778	36°04.861	2171
002	YU	SS	OL	HEZ	25	997	33°58.831	36°04.831	2177
003	YU	SS	OL	FRZ	33	1096	33°53.274	35°56.382	2187
004	YU	SS	OL	FRZ	36	906	33°50.418	35°57.817	2203
005	YU	SS	OL	RYK	40	916	33°51.807	35°59.392	2216
006	YU	SS	OL	RYK	41	946	33°51.230	36°00.902	2219
007	WC	LS	OL	JBJ	44	908	33°37.370	35°46.243	2242
008	WC	LS	OL	KML	53	918	33°37.773	35°47.545	2272
009	EC	LS	OL	JBJ	45	914	33°36.867	35°46.327	2246
010	WC	LS	OL	TW2	46	910	33°36.259	35°44.060	2247
011	WC	LS	OL	BAL	47	912	33°35.449	35°43.492	2256
012	EC	LS	OL	BAL	47	912	33°35.449	35°43.492	2252
013	EC	LS	OL	TW1	48	955	33°34.463	35°43.578	2259
014	EC	LS	OL	QRN	49	919	33°33.553	35°42.867	2261
015	WC	LS	OL	QRN	49	919	33°33.553	35°42.867	2262
016	WC	LS	OL	QRN	50	917	33°32.772	35°42.032	2263
017	WC	LS	OL	TW3	52	910	33°37.712	35°48.176	2270

0	1	8	Y	U	S	S	O	L	H	E	Z	28	983	33°57.966	36°04.775	2183
0	1	9	O	U	S	S	O	L	Q	R	M	58	1099	33°52.154	35°52.873	2475
0	2	0	O	U	S	S	O	L	Z	H	L	61	892	33°48.047	35°54.777	2484-2485
0	2	1	O	U	S	S	O	L	J	D	T	68	934	33°48.791	35°50.538	2512
0	2	2	O	U	S	S	O	L	C	H	T	71	888	33°47.056	35°51.577	2523
0	2	3	O	U	S	S	O	L	M	R	J	73	880	33°46.122	35°52.096	2528
0	2	4	O	U	S	S	O	L	M	R	J	75	879	33°46.352	35°53.003	2535
0	2	5	O	U	S	S	O	L	T	N	L	76	890	33°47.421	35°51.862	2542
0	2	6	O	U	S	S	O	L	A	N	J	83	882	33°45.150	35°56.236	2566
0	2	7	G	U	S	S	O	L	K	B	L	89	889	33°47.325	35°50.743	2705
0	2	8	G	U	S	S	O	L	A	M	Q	90	884	33°47.114	35°51.031	2710
0	2	9	G	U	S	S	O	L	A	M	Q	92	877	33°45.403	35°48.347	2713
0	3	0	G	U	S	S	O	L	M	A	N	95	868	33°40.786	35°49.098	2742
0	3	1	G	U	S	S	O	L	L	U	C	104	892	33°39.029	35°50.556	2746
0	3	2	G	U	S	S	O	L	G	H	Z	105	867	33°40.149	35°49.198	2750
0	3	3	G	U	S	S	O	L	J	B	J	108	869	33°38.386	35°46.791	2758
0	3	4	G	U	S	S	O	L	J	B	J	111	889	33°37.601	35°46.393	2765
0	3	5	Y	U	S	S	O	L	H	S	D	133	975	33°56.620	36°03.682	2851

Sediment - SED

Serial No.	C	S	Sample	Village	Ref.	Elev.	North	East	Photo ID
001	YUSSEDFRZ				36	906	33°50.418	35°57.817	2196-2202
002	OUSSEDQRM				58	1099	33°52.154	35°52.873	2476
003	OUSSEDMRJ				74	882	33°46.037	35°52.622	2529
004	GUSSEDJBJ				108	869	33°38.386	35°46.791	2754-2757
005	0USSEDSGB				143	844	33°36.741	35°42.453	2783-2789
006	S01SEDLAK				145	850	33°36.427	35°42.342	
007	S04SEDLAK				151	851	33°35.381	35°41.754	
008	S07SEDLAK				154	854	33°34.856	35°41.910	
009	S10SEDLAK				157	855	33°34.199	35°41.842	
010	S13SEDLAK				160	855	33°32.910	35°41.530	

4.4. SAMPLE LOG SHEETS

4.4.1. GROUND WATER (WELL) SAMPLES

Date: ----------
Sample Code: ----------
Name of Sampler: ----------
Owner's Name: ----------
Address & Phone #:----------

Photo ID: ----------
GPS Coordinates: Reference #: ----------
E: ---------- N: ---------- Elevation: ---------- m
Age of Well: ----------years
Depth of Well: ----------m **Pumping Rate:** ----------m^3/day
Availability of Well Screen: Yes ☐ No ☐
If yes, Specify type of Screen: ----------
Type of Water Usage:

- Domestic ----------
- Irrigation ----------
- Industrial----------
- Others, Specify:----------

Onsite Water Quality Analysis:

Temperature T^{0}C	Dissolved Oxygen (DO) mg/L	pH	Electrical Conductance (CND) µS/cm	Total Dissolved Solids (TDS) mg/L	Redox (OPR) mV

General Remarks :----------

4.4.2. GROUND WATER (SPRING) SAMPLES

Date: ----------
Sample Code: ----------
Name of Sampler: ----------
Location: ----------
GPS Coordinates: Reference #:-------
E: ---------- N: ---------- Elevation: ----------m
Photo ID: ----------
Type of Water Usage:

- Domestic ----------
- Irrigation ----------
- Industrial----------
- Others, Specify:----------

Type of Sample Collected: Grab ☐ Composite ☐
Samples Collected for:

☐ Routine Physico-chemical Analysis Heavy Metals ☐
☐ Pesticides/Pharmaceuticals & Personal Care Products (PPCPs)
☐ Bacteriology ☐Virology ☐Parasitology
Weather Conditions: ☐Sunny ☐Rainy ☐ Cloudy ☐ Windy

Onsite Water Quality Analysis:

Temperature T^0C	Dissolved Oxygen(DO) mg/L	pH	Electrical Conductance (CND) µS/cm	Total Dissolved Solids (TDS) mg/L	Redox (OPR) mV

General Remarks :----------

4.4.3. SURFACE WATER SAMPLES

Date: ----------

Sample Code: ----------

Name of Sampler: ----------

Sampling Location/ Station: ----------

GPS Coordinates: Reference #:---------

E: ---------- N: ---------- Elevation: ---------- m

Photo ID: ----------

River Bed Description: Depth: -----m Width:-----m Flow Rate: -------- mph

Type of Water Usage:

- Domestic ----------
- Irrigation ----------
- Industrial----------
- Others, Specify:----------

Type of Sample Collected: Grab ☐ Composite ☐

Samples Collected for:

☐ Routine Physico-chemical Analysis ☐Heavy Metals

☐ Pesticides/Pharmaceuticals & Personal Care Products (PPCPs)

☐ Bacteriology ☐ Virology ☐Parasitology

Weather Conditions: ☐Sunny ☐ Rainy ☐ Cloudy ☐ Windy

Onsite Water Quality Analysis:

Temperature T^0C	Dissolved Oxygen (DO) mg/L	pH	Electrical Conductance (CND) µS/cm	Total Dissolved Solids (TDS) mg/L	Redox (OPR) mV

General Remarks :----------

4.4.4. WASTEWATER EFFLUENTS

Date: ----------

Sample Code: ----------

Name of Sampler: ----------

Sampling Location/ Station: ----------

Type:

- Domestic (Sewage): ----------
- Industrial effluent: ----------
- Agriculture runoff : ----------
- Storm Water: ----------
- Others, Specify:----------

GPS Coordinates: Reference #:---------

E: ---------- N: ---------- Elevation: ---------- m

Photo ID: ----------

Type of Sample Collected: ☐ Grab ☐ Integrated ☐

Samples Collected for:

☐ Routine Physico-chemical Analysis Heavy Metals

☐ Pesticides/Pharmaceuticals & Personal Care Products (PPCPs)

☐ Bacteriology Virology ☐ Parasitology ☐

☐ BOD & COD

General Remarks:----------

4.4.5. SOIL SAMPLES

Date: ----------

Sample Code: ----------

Sampling Location/ Station: ----------

GPS Coordinates: Reference #: ----------

E: ---------- N: ---------- Elevation: ---------- m

Photo ID: ----------

Types of Crops

☐Winter Su☐mer Round☐ear Other, specif☐ ----------

Method of Irrigation

☐Drop Spra☐ Flood ☐ Other, specify☐----------

Frequency of Irrigation:

☐ Once/week Twic☐/week 3X/week☐ > 3X/week ☐ other, specify: ----------

General Remarks:----------

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5. APPENDIX V: DETAILED DESCRIPTION OF THE UPPER LITANI BASIN

Figure 1: Schematic Diagram (not to scale) of the Color Coded Zones of the Upper Litani Basin

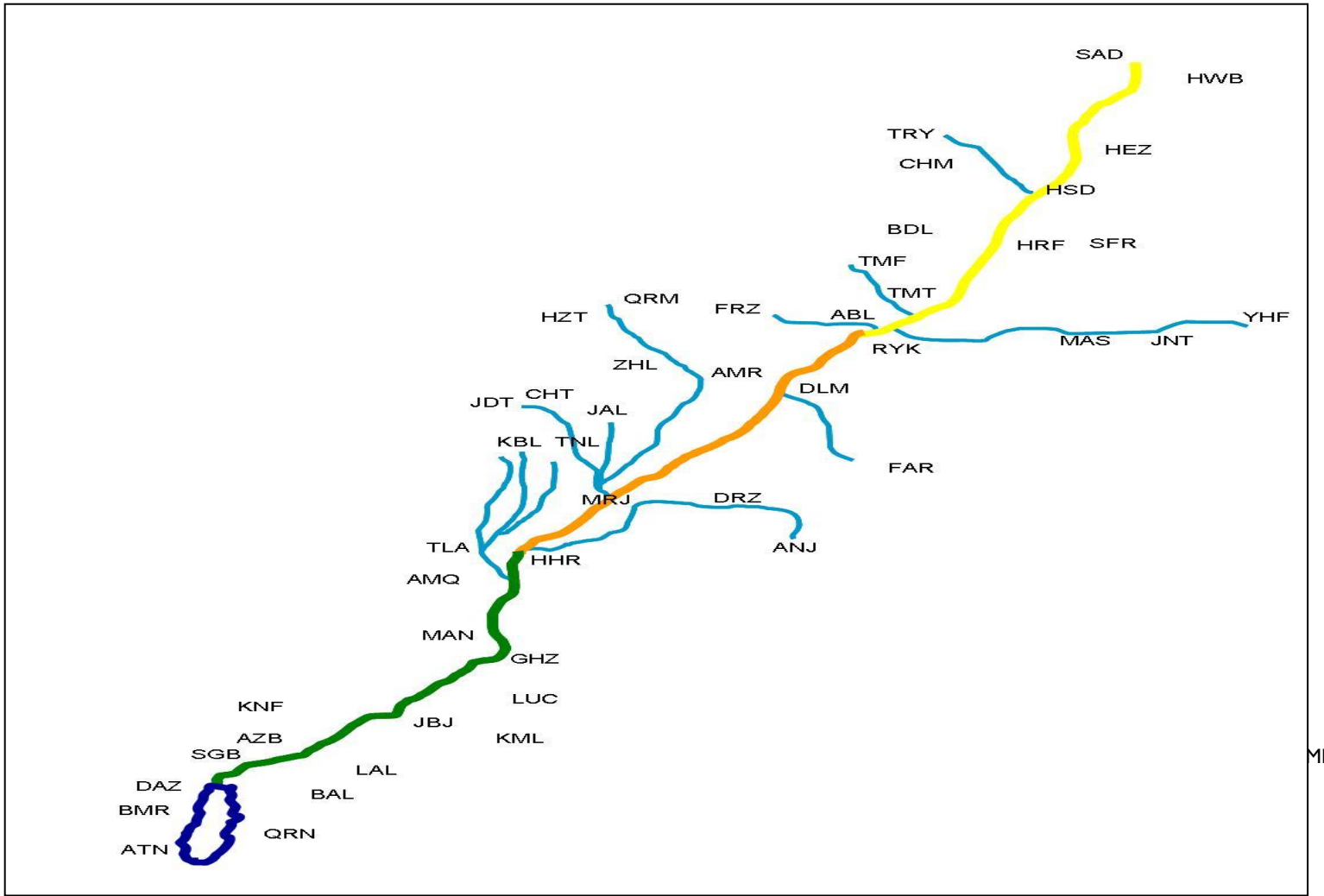
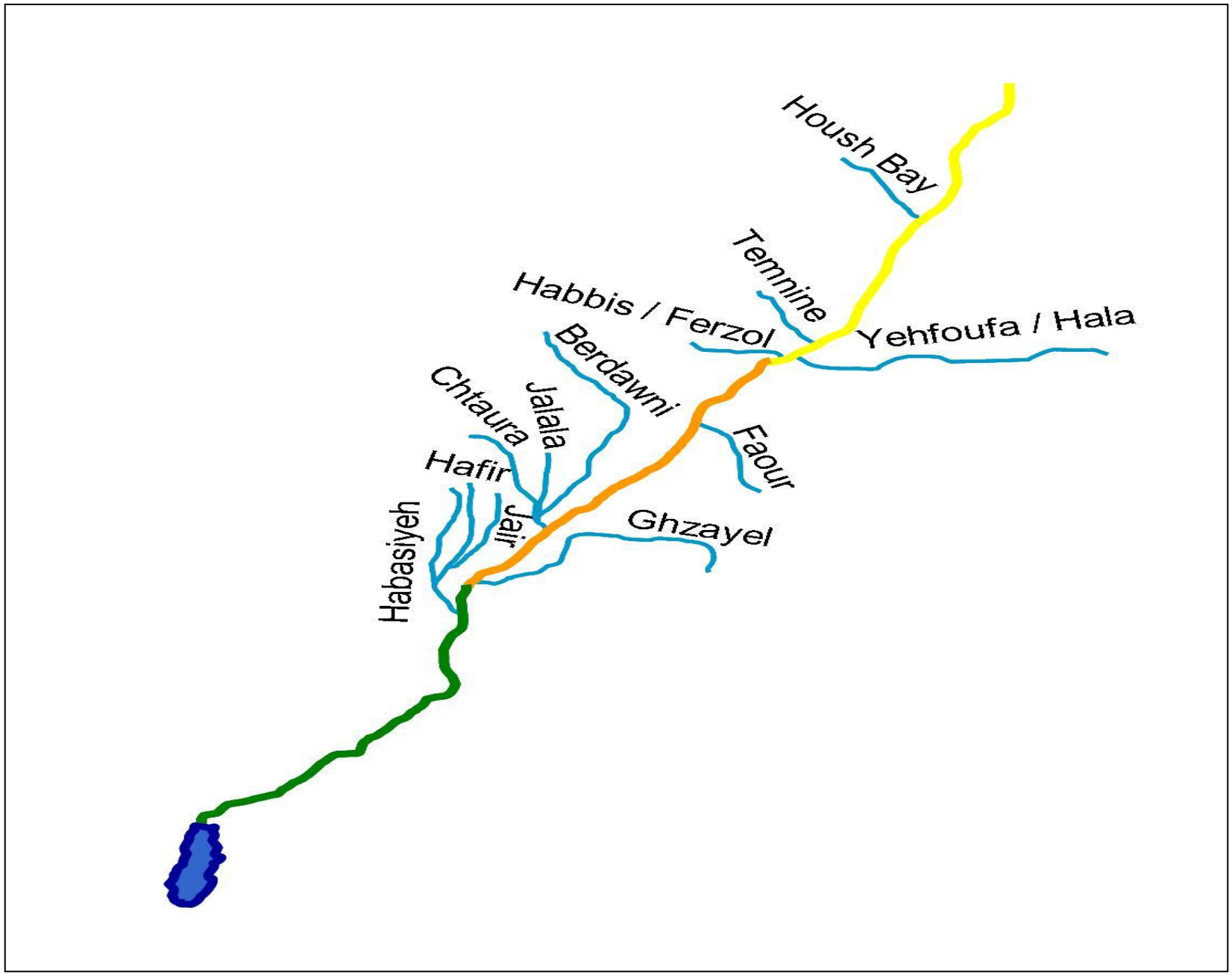


Figure 2: Schematic Diagram (not to scale) of Upper Litani Basin tributaries



5.1. THE YELLOW ZONE (UPPER)

This Region of the Upper Litani River Basin is mainly characterized by mixed residential, agricultural and industrial activities. The river flow is relatively minimal and mostly non-existing and is mainly constituted and sustained by sanitary sewage discharge and industrial wastewater effluents. Moreover, the water is mostly stagnating, has a foul smell and a dark black color and supports the excessive growth of Bamboo and Lavender plants. The main Litani Tributaries in this zone are the Housh Bay Tributary, Temnine Tributary, the Habbis/Ferzsol Tributary and the Yahfoufa/ Hala Tributary. The identified point and non point sources of pollution and the sampling sites are presented in Appendix II. G.3.

5.1.1. . SAIDI (SAD);

West of the Litani River Basin and characterized by the residential and agricultural activities and the presence of Bedouns' summer settlements. The main sources of contaminants are agricultural runoff water, cesspools and solid wastes dumps. The river water flow is minimal and the presence of fish and tadpole in water was noted. Furthermore, the flow is mainly constituted from well water pumped for irrigation

Figure 3: Saidi Canal

5.1.2. HOUSH BARADA (HWB);

East of the Litani River Basin and characterized mainly by agricultural activities and the presence of Bedouns' summer settlements. The main sources of contaminants are agricultural runoff water and solid wastes dumps. The river bed is mostly dry during summer in this area

Figure 4: Litani River in Housh Barada

5.1.3. TARAYA (TRY);

West of the Litani River Basin and characterized by residential, agricultural and recreational activities. This area contributes to the Litani River the Housh Bay Tributary that originates from Housh Bay Water Spring (Roman Ruins Site). The main sources of contaminants are agricultural runoff water and domestic wastewater discharge from Taraya and Chemistar

Figure 5: Housh Bay Water Spring

5.1.4. HOUSH SNEID (HSD);

East of the Litani River Basin and is mainly characterized by agricultural (wheat, vegetables and tobacco plantation), residential and industrial activities. In addition, a major dairy processing plant (Liban Lait) which is located in this area. The main sources of contaminants are agricultural runoff water and domestic wastewater discharge from Housh Sneid and the industrial effluent of Liban Lait.

Figure 6: : Litani River in Housh Sneid

5.1.5. CHEMISTAR (CHM);

West of the Litani River Basin and is mainly characterized by residential and agricultural activities and the presence of small scale dairy plants.

Figure 7: Housh bay Tributary contaminated by Chemistar wastewater

The main sources of contaminants are agricultural runoff water and domestic wastewater from Taraya and Chemistar into the Housh Bay Tributary.

5.1.6. HEZEINE (HZ);

East of the Litani River Basin and mainly characterized by residential and agricultural activities. The main sources of contaminants are agricultural runoff and domestic wastewater from Hadath Baalbak and Hezeine. The river water is mostly stagnating, black in color water and supports the excessive growth of Bamboo and Lavender.

Figure 8: Litani River In Hezeine

5.1.7. BEDNAYL (BDL);

West of the Litani River Basin and is mainly characterized by residential and agricultural activities. The main sources of contaminants are agricultural runoff and domestic wastewater. The river bed is completely dry and the domestic is mostly tapped for irrigation.

Figure 9: Litani River in Bednayel

5.1.8. HOUSH RAFKA (HRF);

East of the Litani River Basin and is mainly characterized by residential and agricultural activities. The main sources of contaminants are agricultural runoff and domestic wastewater. The river bed is mostly dry with stagnating domestic wastewater that supports the growth of Bamboo and Lavender.

Figure 10: Litani River in Housh Rafka

5.1.9. SIFRI (SFR);

East of the Litani River Basirr (not directly located along the river bed); all water springs are dry and the main well was closed by Government. The wastewater is mostly tapped for agricultural use and the sewerage network is not yet completed. The main sources of contaminants are agricultural runoff and domestic wastewater

5.1.10. TEMNINE AL FAWKA (TAF);

West of the Litani River Basin. This area contributes to the Litani River the Temnine Tributary that originates from Jeb el Habach water spring (Roman Ruins Site). The main sources of contaminants are agricultural runoff water and cesspools.

Figure 11: Jeb El Habach Spring

5.1.11. TEMNINE AL TAHTA (TMT);

East of the Litani River Basin and is mainly characterized by residential, agricultural and industrial activities (stone cutting industry). The main sources of contaminants are agricultural runoff, domestic wastewater and industrial wastewater effluents. This tributary is dry in summer.

Figure 12: Litani River in Temnine Al Tahta contaminated by industrial waste

5.1.12. ABLAH (ABL);

West of the Litani River Basin and is mainly characterized by agricultural and industrial (main poultry processing plant and plastic industries) activities. The main sources of contaminants are agricultural runoff and domestic wastewater (Treatment plant under construction) and industrial wastewater effluents that are discharged directly into the Litani River through subsurface channels.

Figure 13: Litani River in Ablah contaminated by industrial waste

5.1.13. FERZOL (FRZ);

Located west of the Litani River Basin and contributes to the Litani River the Habbis/Fersol Tributary that originates from the Habbis Water Spring. The main sources of contaminants are agricultural runoff, domestic wastewater (wastewater treatment plant; completed and functional) and industrial wastewater effluents

Figure 14: Wastewater Treatment Plant in Ferzol

5.1.14. RAYAK (RK);

East of the Litani River Basin and is mainly characterized by residential (specifically the location of Lebanese army barraks and residential units) and agricultural activities. The main sources of contaminants are agricultural runoff and cesspools.

5.1.15. YAHFOUFA (YHF);

East of the Litani River Basin and is mainly characterized by residential and recreational activities. This area contributes to the Litani River the Yahfoufa/ Hala Tributary that originates from the Yahfoufa (Jowsha) springs. This Tributary is exposed to WW from Sergaia (Mohafazat Al Zabadani in Syria).

Figure 15: Hala River Tributary in Yahfoufa

5.1.16. JANTA (JNT);

East of the Litani River Basin and is mainly characterized by residential and recreational activities. Main sources of contaminants are agricultural runoff and cesspools.

Figure 16: Hala River Tributary in Janta

5.1.17. MASA (MSA);

East of the Litani River Basin and is mainly characterized by residential and recreational activities. Main sources of contaminants are agricultural runoff and cesspools.

Figure 17: Hala River Tributary in Masa

5.2. THE ORANGE ZONE (MIDDLE)

This Region of the Upper Litani River Basin and is mainly characterized by mixed residential, agricultural, industrial and recreational activities. It contributes to the Litani River the main tributaries of Berdawni, Chtoura, Ghzayel and Faour and the Storm Water Runoff of Jalala. The identified point and non point sources of pollution and the sampling sites are presented in Appendix III.G.3.

5.2.1. QAA EL REEM (QRM), HAZERTA (HRZ), ZAHLE (ZHL) AND AMROUSEIH (AMR); "BERDAWNI TRIBUTARY";

West of the Litani River Basin and the area is mainly characterized by residential and agricultural and main industrial activities. This area contributes to the Litani River the Berdawni Tributary, which originates from Qaa El Rim Springs and flows through Zahle and Amrouseih. It then joins the Chtoura Tributary in the Marj Area, before flowing into the Litani River in the same Area.

Figure 18: Berdawni River Tributary in Qaa El-Reem

Figure 19: Berdawni River Tributary in Zahle

5.2.2. JDEITA (JDT), CHTOURA (CHT) AND TAANAYEL (TNL); "CHTAURATRIBUTARY";

West of the Litani River Basin and the area is mainly characterized by residential, agricultural, industrial and commercial activities. This area contributes to the Litani River the Chtoura Tributary that originates from the Jdeita Spring and Chtoura Springs. This Tributary passes through Taanayel and into the Marj Area where it meets the Berdawni Tributary, then flows into the Litani River in the same Area.

Figure 20: Chtaura Spring

Figure 21: Chtaura River Tributary

Figure 22: Chtaura River Tributary in Taanayel

Figure 23: Chtaura River

5.2.3. JALALA (JAL); "JALALA STORM WATER TRIBUTARY";

West of the Litani River Basin and is mainly characterized by residential, agricultural, industrial and Commercial activities. This Storm Water Runoff meets the Litani River in Al Marj area

Figure 24: Jalala Storm water Tributary

5.2.4. ANJAR (ANJ), DIER ZANOUN (DRZ) AND HOUSH AL HARIMI (HHM); "GHZAYEL TRIBUTARY";

West of the Litani River Basin and the area is mainly characterized by residential, agricultural, industrial, recreational activities and large Bedouins' Summer Settlements. This Area contributes to the Litani River the Ghzayel Tributary that originates from Anjar and Chamsine Water Springs flowing through Dier Zanoun and the Litani River in Housh AL Harimi.

Figure 25: Anjar Spring in Anjar

Figure 26: Figure 26: Ghzayel River Tributary in Anjar

Figure 27: Ghzayel River TributarY meeting with Litani River in Hosh Al Harimi

5.2.5. FAOUR (FAR) AND DALHAMEYIEH (DLH); "FAOUR TRIBUTARY";

East of the Litany River Basin and the area is characterized by residential and agricultural activities and the presence of animal farms. This area contributes to the Litani River the Faour Tributary that originates from the Faour Springs and flows into the Litani River in the Dalhameyieh Area.

Figure 28: Faour River Tributary in Faour

5.3. THE GREEN ZONE (LOWER)

This Region of the Upper Litani River Basin is mainly characterized by mixed residential, agricultural industrial and recreational activities. The River starts with minimal water flow, and supports extensive algae growth and the presence of fish, water snakes and turtles etc. and flows into the Quaroun Lake with relatively more water input due to the feeding of major water springs and tributaries (Habasiyeh, Hafir and Jair) in this Zone.

5.3.1. KOBB ELIAS (KBL);

Figure 29: Ras Al Ain Water Spring

West of the Litani River Basin and is mainly characterized by residential and agricultural activities. The main sources of contaminants are Quarries (Uphill), agricultural runoff water and domestic wastewater discharge. This area contributes to the Litani River the three Tributaries of Habasiyeh, Hafir and Jair originating from the Ras al Ain Water Springs .

Figure 30: Habasiyeh River Tributary

Figure 31: Hafir and Jair River

5.3.2. TAL AL AKHDAR (TLA);

West of the Litani River Basin and is mainly characterized by agricultural activities. The main sources of contaminants are the agricultural runoff water and domestic wastewater discharge. This area is the meeting junction of the three water tributaries of Habasiyeh, Hafir and Jair before flowing into the litany river in Housh Ammiq/Souh Marj Area.

Figure 32: Habasiyeh, Hafir and jair Rivers Tributary before meeting with Litani River in Tal Al Akhdar

5.3.3. AMMIQ/HOUSH AMMIQ/SOUTH MARJ AREA (AMQ);

West of the Litani River Basin and is mainly characterized by residential, agricultural (mainly seasonal vegetables) and industrial activities (SICOMO paper industry, PETCO plastic industry, cement and ceramic industries etc.) in addition to Bedouns' summer settlements activities. The main sources of contaminants are agricultural runoff water and domestic wastewater discharges (Qoob Elias and Maksi) and industrial wastewater discharges. This area is the meeting junction of the three water tributaries of Habasiyeh, Hafir and Jair before flowing into the litany river in Housh Ammiq/Souh Marj Area

Figure 33: Sicomo Wastewater

5.3.4. MANSOURA (MAN);

West of the Litani River Basin and is mainly characterized by residential activities. The main sources of contaminants are agricultural runoff water and domestic wastewater discharges (Luci, Ghazza & Mansoura). The river in this area is characterized by excessive algae growth and the presence of fish, ducks, water snakes, turtles etc.

Figure 34: Litani River in Mansoura

5.3.5. 3.2. A.I. GHAZZA (GHZ);

West of the Litani River Basin and is mainly characterized by residential activities in addition to Bedouns' summer settlements. The main sources of contaminants are agricultural runoff water and domestic wastewater discharges (Luci, Ghazza & Mansoura). The river in this area, also, is characterized by excessive algae growth and the presence of fish, ducks, water snakes, turtles.

Figure 35: Wastewater Discharge in Ghazza

5.3.6. LUCI/ SULTAN YAAKOUB (LUC);

East of the Litani River Basin and is mainly characterized by residential and agricultural activities. The main sources of contaminants are agricultural runoff water and domestic wastewater discharge. This area is not directly located along the river bed.

Figure 36: Luci Wells

5.3.7. KHERBIT KANAFAR (KNF);

West of the Litani River Basin and is mainly characterized by residential and agricultural and recreational activities. The main sources of contaminants are agricultural runoff water and domestic wastewater discharge (will be connected to Jeb Jenine or Bab Marea Wastewater Treatment Plants). This area is not directly located along the river bed.

Figure 37: Khrayzat Spring in Kherbit Kanafar

5.3.8. AIN ZEBDEH (AZB);

West of the Litani River Basin and is mainly characterized by residential activities and Trout fish aquaculture. This area contributes major water springs that feed into the Litani River but is not directly located along the River bed.

Figure 38: Al Asafir Spring in Ain Zebdeh

5.3.9. JEB JENINE (JBJ);

East of the Litani River Basin and is mainly characterized by residential and agricultural activities and gets irrigation water from Canal 900. The main sources of contaminants are agricultural runoff water and domestic wastewater discharge. A wastewater treatment plant is under construction and this plant is located directly along the river bed and will treat the wastewater of 19 villages.

Figure 39: Litani River in Jeb Jenine

5.3.10. KAMED AL LOUZE (KAL);

East of the Litani River Basin and is mainly characterized by residential and agricultural activities and the lower part of the village is irrigated by Canal 900. This area is not directly located along the river bed.

5.3.11. SOGHBEINE (SGB);

West of the Litani River Basin and is mainly characterized by residential, agricultural and industrial activities (**s**mall scale industries; sugar cane, & ceramics). A Wastewater Treatment plant, located directly by the lake is under construction. This projected point source if not properly managed will enhance the nitrates and phosphates levels in lake water and hence the growth of algae

Figure 40: Litani River across Soghbeine

5.3.12. LALA (LAL);

East of the Litani Basin and is mainly characterized by residential, agricultural and industrial activities (stone cutting industries). This area is not directly located along the river bed.

Figure 41: Cutting Stone Industry in Lala

5.3.13. DEIR AIN AL JAWZEH (DAZ);

West of the Litani River Basin and is mainly characterized by residential, agricultural activities. This area oversees the Quaroun Lake and contributes the Ain AL Jawzeh water springs.

Figure 42: Figure 42: Ain Al Jawzeh Spring

5.3.14. BAB MEREA (BMR);

West of the Litani River Basin and is mainly characterized by residential, activities. This area oversees the Quaroun Lake. A Wastewater Treatment plant (WW from Sagbeine, located directly by the lake is under construction.

Figure 43: Wastewater Treatment Plant in Bab Merea

5.3.15. BAALOUL (BAL);

East of the Litani River Basin and is mainly characterized by residential, activities. Oversees the lake and contributes the outflow of the Ain Al Tout Water Spring (the Blue Project).

Figure 44: The Blue Project in Baaloul

5.3.16. AITANEIT (ATN);

West of the Litani River Basin and is mainly characterized by residential, activities and is located by the Lake. The wastewater discharge will be treated in the Bab Marea treatment plant along the Quaroun Lake.

Figure 45: Ain Al Deb Spring in Aitaneit

5.3.17. QUAROUN (QRN);

East of the Litani River Basin and is mainly characterized by residential, activities and is located by the Lake. This area contributes major water springs of Ain El Deir, Ain Al Jamea, Ain Barada, Ain El Harf and Ain El Diaa.

Figure 46: Ain Al Jamaa Spring in Quaroun

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